AMERICAN JOURNAL OF INDUSTRIAL MEDICINE 42:543–544 (2002)

# Risk Communication in the Aftermath of the World Trade Center Disaster

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*KEY WORDS: air pollution; dust; particulate matter; soot; risk assessment*

## INTRODUCTION

The attack on the World Trade Center (WTC) was an unprecedented disaster that resulted in a tragic loss of human life and environmental exposures that were unlike any prior experience. At the outset, government agencies rushed to reassure the public with announcements of ''safety'' that were based on limited information. The experience of the public ran contrary to the government pronouncements; acrid smells, clouds of smoke and soot, and what has been termed the ''World Trade Center Cough.'' Public confidence declined in the government's data and environmental assessments of safety. As a result of this, some environmental and health agency representatives seemed more reticent to speak at public meetings or to the press, thus compounding public fears and uncertainty.

In the days and weeks that followed, the public turned more to alternative sources of information in order to evaluate the veracity of government statements. Physicians, occupational medicine specialists, academics, environmental consultants, and the residents living near the site were asked for their opinions. Differing assessments of short- and long-term dangers appeared in the media and caused further uncertainty and fear. In the absence of directly applicable environmental guidelines or limits for such disaster situations, some in the press inappropriately applied short-term exposure measurements to long-term standards for contaminants such as lead, dioxin, and asbestos, and thereby heightened public fears that still exist in Lower Manhattan.

## METHODS

It is known that exposures to high levels of particulate matter air pollution, such as soot, can produce severe health effects which may include heart attacks, exacerbation of asthma and emphysema, and other preexisting pulmonary conditions. One day following the attack, a team from the NYU Department/Division of Environmental Health initiated testing of particle air pollution. The proximity of NYU allowed our team (and colleagues from UMDNJ) to collect ground ''fallout'' dust samples from September 12 to September 17, 2001, daily fine particle mass and hourly airborne carbon samples at the NYU Downtown Hospital (located 5 blocks to the east of Ground Zero) and at the NYU Medical Center at First Avenue and 26th Street.

Analyses of these air pollution and fallout dust samples began immediately. Elemental and organic carbon levels in soot in Lower Manhattan were found to be highest at night but to have decreased over time. They became more similar to those levels found in midtown Manhattan by mid-October. The particulate number concentration tested from September 29 to October 5, 2001 was not unlike measurements made in Manhattan in the past, indicating that ultrafine particle pollution was not unusually high. Fine particle mass levels at NYU Downtown Hospital were found to be higher at night, but were generally within the EPA legal limit when averaged over a 24-hr period. As shown in Figure 1, soot impacts from the fires were also elevated at night (when wind speeds declined) in the month following the disaster, but soot levels decreased on rainy days (e.g., 9/24 and 9/29) and over time as the fires were put out.

Analyses of the dust samples demonstrated that almost all WTC dust particles were larger than 10 μm, and would

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Grant sponsor: NIEHS Center; Grant number: ES00260; Grant sponsor: NYU-U.S. EPA Particulate Matter Center; Grant number: R827351.

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Accepted 25 September 2002
DOI 10.1002/ajim.10163. Published online in Wiley InterScience (www.interscience.wiley.com)

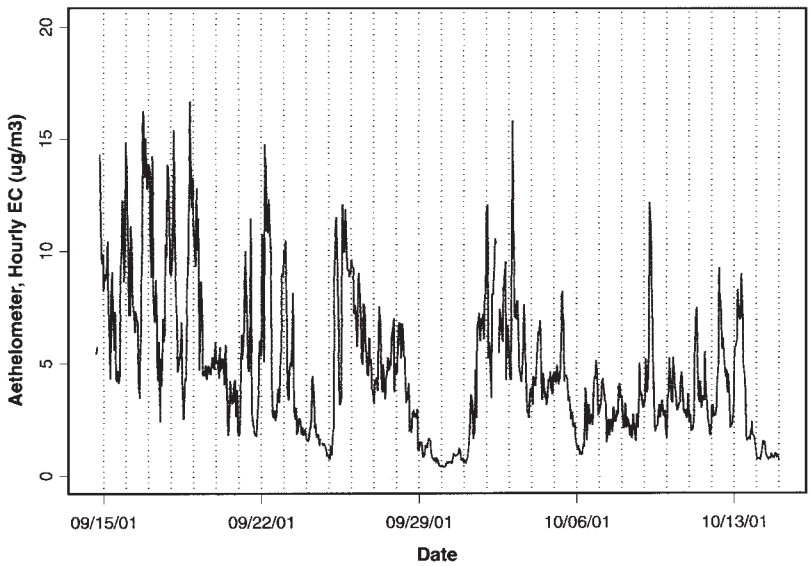


**FIGURE 1.** Elemental carbon (soot) levels (September 15-October 15, 2001) were elevated in lower Manhattan at night in the weeks following the disaster, but declined over time as the fires diminished.

therefore not easily penetrate into the lung, in contrast to the smaller particles that could. Low outdoor levels of asbestos were found in the dust. Analysis for lead showed elevated levels in the dust on the ground, but those were lower than permissible limits for playground soil; they ranged from 38–330 ppm. Other metals were analyzed in the fallout dust by Clive Neal, PhD at the University of Notre Dame and Steven Chillrud, PhD at the Lamont-Doherty Earth Observatory of Columbia University. Neal found concentrations above crustal material of arsenic, cadmium, cesium, molybdenum, lead, antimony, tin, tungsten, and zinc. NYU's elemental analysis of the ambient fine particle concentrations at the NYU Downtown Hospital showed elevated peaks in lead, chlorine, and other WTC fire plume constituents when the wind was from the West until mid-October, when the fires diminished. After that time, calcium, silicon, and other crustal dust constituents dominated the WTC impacts, as the cleanup operations proceeded, ''kicking up'' WTC dust at the same time.

Our fine particle mass concentration results from the NYU Downtown Hospital were largely consistent with EPA data for the period from late September onward, finding that the fine mass concentrations were generally within legal limits when averaged over a 24-hr period. However, the fallout dust characteristics (especially its strong alkalinity) are consistent with symptoms of short-term upper airway irritation and the ''World Trade Center Cough'' reported by local residents, but not with deep lung damage or long-term risks. However, there were short-term particle mass peaks, usually during the night that were potentially hazardous for especially sensitive populations (e.g., older adults and people with pre-existing respiratory problems, such as asthma).

## LESSONS LEARNED

- It has become clear that the public wants facts upon which they can make individual decisions, not just reassurances. The Lower Manhattan population's confidence in government environmental agencies has been seriously eroded in this case.
- It is critical to public health and safety that the government develop peer-reviewed pollution benchmarks of ''acceptable'' and ''unacceptable'' exposures applicable to such disaster situations and make them available to the public and the media.
- Should another such large-scale environmental disaster occur, physicians, scientists, and other exposure/health effects experts need to be consulted regarding the appropriateness of government monitoring and health effects assessments on a real-time basis.

## ACKNOWLEDGMENTS

The authors wish to thank the following for their contributions to the collection of the data discussed in this paper: M. Blaustein, S.I. Hsu, M.D. Cohen, C. Prophete, G. Chee, K. Shermerhorn, J. Dufy, P. Maciejczyk, M. Zhong, J. Xiong, C. Quan, X. Lo, P. Peters, M. Heikkinen, M. Kendall, J. Clemente, L. Schuetz, B. Cohen, M. Lippmann, and M. Costa of the NYU SOM; Steve Chillrud of Lamont Doherty Earth Observatory (Columbia University); and Clive Neal of the Department of Civil Engineer and Geological Science, University of Notre Dame.

These investigations were supported by the National Institute of Environmental Health Sciences (NIEHS Center Grant ES00260), and the NYU-U.S. EPA Particulate Matter Center (R827351).